ORIGINAL

BEFORE THE

Federal Communications Commission

WASHINGTON, D.C. 20554

In the Matter of	)	93-62
	)	
Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation	)	ET Docket No. 93-62
	)	
	)	

To: The Commission

COMMENTS OF TRW INC.

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SUMMARY

TRW Inc. ("TRW") hereby submits its comments in response to the Commission's proposal to promulgate rules that reflect the radiofrequency ("RF") radiation guidelines recently adopted by the American National Standards Institute and the Institute of Electrical and Electronic Engineers (the "ANSI/IEEE guidelines"). TRW asks the Commission to clarify and revise certain aspects of its proposals, insofar as the proposals affect the proposed regulatory treatment of RF exposure from relatively low-power hand-held devices.

First, TRW believes the Commission's tentative proposal to regulate all hand-held devices under the restrictive "uncontrolled environment" standard from the ANSI/IEEE guidelines is unnecessarily restrictive. For the handsets that would be used with "Odyssey," TRW Inc.'s trademark for a satellite telecommunication system which is to be comprised of a constellation of twelve satellites in a medium Earth orbit, only the user is close enough to the radiation source to be affected by RF radiation, and there thus is no danger of exposure to non-users or unaware individuals. In view of the nature of the devices' use and the generally low exposure levels (the handsets should be able to comply with all ANSI/IEEE guidelines under average-use conditions), any potential effects of RF radiation will be mitigated through a combined program of consumer education and strategic design of the equipment itself.

The handsets for use with Odyssey should thus be regulated under the controlled environment guidelines for all users.

On other aspects of the Commission's proposals, TRW supports the tentative determination to exclude low-power devices, but calls upon the Commission to provide a meaningful definition of the term "radiating structure." In addition, TRW believes that the Commission should require specific absorption rate measurements that are based on unambiguous field strength readings at specific frequencies and distances from the subject devices, in order to ensure uniform conformity to recognized health standards. TRW also believes that the ANSI/IEEE guidelines are to be preferred over the other guidelines referenced in the Commission's NPRM.

Next, TRW is of the view that the Commission should require measurement and recertification of existing equipment in certain instances. With the implementation of the new guidelines, receiving equipment will have to be increasingly sensitive to receive communications from lower-emission devices. In situations where these lower-emission devices will share spectrum with older, higher-power transmitters, the new equipment will be unusually susceptible to interference, and recertification would be necessary. Grandfathering of older equipment should be acceptable in cases where the transmitters do not negatively affect the ability of lower-emission devices to communicate.

Finally, TRW urges the Commission to embrace, for each product type, a single unambiguous test that all manufacturers can use to ascertain compliance. The ANSI/IEEE standards themselves offer many options for measuring RF radiation, but do not offer a single "standard" measurement apparatus or practice.

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TRW Inc. ("TRW"), by its attorneys and pursuant to Section 1.415 of the Commission's rules, hereby comments on the Commission's notice of proposed rule making in the above-captioned proceeding, Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation, 8 FCC Rcd 2849 (1993) ("NPRM").[1/] As explained below, TRW asks for clarification and modification of certain aspects of the Commission's proposals that affect the proposed treatment of radiofrequency ("RF") exposure from hand-held devices.

I. INTRODUCTION

In the NPRM, the Commission proposes to adopt as rules the new standards for RF exposure that were adopted by the American National Standards Institute ("ANSI") late in 1992 (and

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1/ The comment deadline specified in the NPRM has been extended three times, most recently to January 25, 1994.

by the Institute of Electrical and Electronic Engineers ("IEEE") in 1991). The Commission notes that the 1992 ANSI/IEEE guidelines are generally more restrictive than the 1982 ANSI standards they replace. NPRM, 8 FCC Rcd at 2850. In addition, the 1992 guidelines specify two sets of exposure recommendations -- one each for "controlled" and "uncontrolled" environments -- where the 1982 standards specified a single set of exposure limits, and include restrictions on currents induced in the human body by RF fields. Id.

In proposing to replace the 1982 ANSI guidelines with the 1992 ANSI/IEEE guidelines for purposes of evaluating the environmental significance of RF exposure, the Commission recognized that it was dealing with "a complex and controversial subject and that the adoption of new guidelines will raise a number of issues and implementation concerns." Id. One of the areas of controversy specifically enumerated by the Commission is the "treatment of hand-held devices . . . ." Id.

TRW has applied for authority to construct a mobile satellite service system called "Odyssey."[2/] As conceived by TRW, one of the ways in which end users would access the satellites of Odyssey is through the use of self-contained hand-held transceivers that will transmit in the 1610-1626.5 MHz band.

2/ Odyssey is a trademark of TRW Inc. Odyssey is a satellite telecommunications system which is to be comprised of a constellation of twelve satellites in a medium Earth orbit.

The typical handset for use with Odyssey (i.e., one with a self-contained radiating source) will operate with an average radiated power of 0.5 Watts. At this date, TRW has not selected a final handset design for use with Odyssey, and its tests on RF exposure from particular antenna types are still at the preliminary stage. Nevertheless, TRW is able to anticipate that if the duration of an average phone conversation via Odyssey is limited to five minutes (or perhaps longer depending on final antenna design selected),[3/] and if the average phone call duration can be used to ascertain compliance (as appears to be permitted under the 1992 ANSI/IEEE guidelines), the handset for use with Odyssey should be able to satisfy the guidelines for RF exposure in both "controlled" and "uncontrolled" environments. See Technical Statement (attached hereto).

In these Comments, TRW addresses those aspects of the Commission's proposals that bear on the classification and operability of the handsets to be used with Odyssey. It urges the Commission to shy away from standards that unduly penalize relatively low-powered consumer devices, and to embrace the concept of user education, in order to provide an appropriate

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3/ The average duration of the voice calls to be transmitted over Odyssey is likely to be between 2.0 and 2.2 minutes per call for typical users, and between 2.2 and 2.3 minutes per call for "rovers" using Odyssey. Market research conducted by TRW reveals that the typical user is likely to use Odyssey for 63 minutes per month (for an average of one call per day).

balance between the need to protect the general public from possible health and safety hazards and the ability of equipment makers and service providers to bring economically viable products to the marketplace.

II. DISCUSSION

A. The Commission Should Consider RF Exposure From Relatively Low-Power Hand-Held Devices As Occurring In A "Controlled" Environment.

In the NPRM, the Commission observed that the 1992 ANSI/IEEE standard states that:

> [c]ontrolled environments are locations where there is exposure that may be incurred by persons who are aware of the potential for exposure as a concomitant of employment, by other cognizant persons, or as the incidental result of transient passage through areas where analysis shows the exposure levels may be above [the exposure and induced current levels permitted for the general public but not those permitted for persons aware of the potential for exposure].

NPRM, 8 FCC Rcd at 2850-51 (no citation in original). It notes that "uncontrolled environments" are defined as "'locations where there is the exposure of individuals who have no knowledge or control of their exposure. The exposures may occur in living quarters or workplaces where there are no expectations that the exposure levels may exceed [the exposure and induced current levels permitted for the general public].'" Id. at 2851 (no citation in original).

Stating its intention to adopt these definitions, the Commission requested comment on criteria to be applied in determining which exposure limits should apply to which radio operations. Citing the involvement of "matters of possible health and safety," the Commission opined that a conservative approach would be appropriate. It indicated that it would apply the more conservative "uncontrolled environment" guidelines in situations where there is any question of possible exposure of the general public to RF radiation (e.g., to transmitters located in residential areas or locations where proximity to the RF source may be unrestricted), but would apply the "controlled environment" guidelines in situations "where exposure is incidental and transitory, or the exposure is incurred in areas where personnel are aware of the exposure potential." Id.

As specifically regards hand-held devices, the Commission made the following proposal:

> [W]e are proposing that as a general policy exposure of *non-users* due to hand-held devices and amateur radio facilities will be considered as occurring in uncontrolled environments unless the user is, "aware of the potential for exposure as a concomitant of employment" (e.g., through training or education) or who is otherwise aware of the potential for exposure (as defined by ANSI/IEEE for persons exposed in controlled environments). . . . The term "non-user" refers to other persons in the immediate vicinity of the user who do not fit the criteria specified by ANSI/IEEE for controlled environments.

NPRM, 8 FCC Rcd at 2851 n.16. The Commission asked commenters to state whether any "non-employees" would fall within the category of persons "otherwise aware of the potential for exposure," and if so, to identify them. Id.

TRW believes that in its understandable effort to tread cautiously where matters of potential public exposure to RF radiation is concerned, the Commission may have proposed to come down too conservatively when it comes to hand-held devices. Keying classification of hand-held devices to a function of the users' employment would not be realistic for several reasons.

First, the power radiated by these low-power devices (including the handsets to be used with TRW's MSS satellite system) is such that the actual user is the only person who could be close enough to the radiation source to be affected. Under calculations performed by TRW, in the absolute worst case (i.e., without figuring in any averaging or accounting for usage characteristics), the handset for use with Odyssey will comply with the "uncontrolled environment" guidelines, irrespective of the type of antenna used, at all points beyond a distance of approximately 18 centimeters (i.e., roughly 7 inches). See Technical Statement at Figure 1. This means that even in the most crowded of public situations, there is no "second-hand smoke" issue to be concerned about from the handset to be used with Odyssey. In other words, there is little or no danger of exposure of individuals who have no knowledge or control of their

exposure to RF fields, or where individuals have no expectation that they are being exposed to RF levels in excess of those permitted -- the hallmarks of the uncontrolled environment. The focus should thus be on the user alone.

When the usage characteristics for the handset to be used with Odyssey are factored in, however, the case for regulation under "controlled environment" conditions becomes even more compelling. The device will be used close to the body for voice telephony. This means that during a three minute phone call (a phone call duration that is nearly one minute longer than the call length that TRW is expecting), the user will be both talking (i.e., transmitting) and listening (i.e., not transmitting). Assuming a very conservative voice activity factor of 50% (35% is more typical), the handset would only be emitting radiation for 1.5 minutes during a call, and those emissions would be random, short bursts, and not a continuous transmission. Even for the user, then, it can be argued that the handset will result in exposure to RF fields that is incidental and transitory in nature.

As noted, the 1992 ANSI/IEEE standards appear to allow "averaging" for the purpose of ascertaining compliance with the guidelines. Figures 2, 3, 4, and 5 of the attached Technical Statement, and the accompanying text, together show that for calls of an average duration of five minutes of less, the maximum handset PFD for Odyssey will be able to comply with the standards

proposed in the NPRM for all antenna designs, and some antenna designs will allow substantially longer call durations with full compliance. See Technical Statement at 2-4.

There is another reason why the Commission's proposal to consider exposure of users to RF fields from hand-held devices as occurring in an uncontrolled environment unless the user is aware of the exposure potential as a function of his or her employment is too harsh. Specifically, many hand-held devices (including the handsets for use with TRW's satellite system) are essentially consumer products that happen to have numerous business applications. For the users of these devices, employment does not necessarily have anything to do with how the device will be used.

As consumers, persons using handsets to access Odyssey can be reasonably expected to exercise sound judgment in the use of the equipment. Further, the design of the handsets for use with Odyssey will ensure that the antenna is at least 2.5 centimeters away from the user's head and hand under normal operating conditions. To ensure the protection of even those consumers who may tend not to exercise sound judgment (i.e., the consumers who need warning labels on electric hair dryers that tell them not to use the device while in the bathtub), all handsets for use with Odyssey could be accompanied with educational materials that instruct the user never to touch the antenna while the handset is being operated and to operate the

device only in the intended position. It will also be possible to produce special handsets that contain an additional enclosure that surrounds the antenna to physically preclude a user from intentionally and abusively placing the handset antenna any closer to their body than is allowed under the uncontrolled environment guidelines. This last step, however, would be an extreme preventive measure, and one that should be considered to be goldplating that is unnecessary in the ordinary course -- i.e., with the expected program that combines strategic antenna/hand placement with reasonable consumer education materials.

By educating users of Odyssey about the manner in which the handsets are properly to be employed, the potential exposure from the devices (which occurs only in a situation where the device is being used improperly anyway) is reduced to negligible levels for handset users, and there is no risk of exposure to non-users. Under these circumstances, the Commission should revisit its proposal to consider exposure of all non-employee hand-held device users to be occurring in uncontrolled environments. See NPRM, 8 FCC Rcd at 2851 n.16. The handsets for use with TRW's MSS system called Odyssey, at least, should be

regulated under the controlled environment guidelines for all users.[4/]

B. TRW Supports The Commission's Proposal To Adopt The 1992 ANSI/IEEE Standards For Excluding Certain Low-Power Devices From Compliance With The Protection Guidelines.

Under the ANSI/IEEE guidelines that would be codified by the Commission, categorical exclusions of certain low-powered devices would be available, based on either radiated power or specific absorption rate ("SAR"). This means that even if a low-power device does not comply with the radiated power guidelines, it may be eligible for an exclusion based on the SAR produced. See NPRM, 8 FCC Rcd at 2851. The Commission notes, however, that

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4/ In its recent Report and Order in Amendment of Section 2.106 of the Commission's Rules to Allocate the 1610-1626.5 MHz and the 2483.5-2500 MHz Bands for Use by the Mobile-Satellite Service, Including Non-geostationary Satellites, FCC 93-547, slip op. at 19 (released January 12, 1994) (footnote omitted) ("MSS/RDSS Report and Order"), the Commission stated that it would "require that all hand-held devices [for MSS/RDSS services use] comply with the new ANSI/IEEE specifications for 'uncontrolled' environments because the new MSS service as envisioned would include consumer use that would be within the 'uncontrolled' definition." The Commission stated, however, that if it were to modify the new ANSI/IEEE guidelines during the course of its instant proceeding (i.e., ET Docket No. 93-62), "those guidelines will be applied to MSS equipment." Id. Because, for the reasons articulated by TRW in these comments, a case has been made for regulating certain MSS handsets (including, at the least, those to be used with Odyssey) under the "controlled" environment standards, the Commission should expressly conclude here that such a determination will apply as appropriate to hand-held equipment in the new MSS/RDSS service.

under the ANSI/IEEE guidelines, no exclusions are available on the basis of radiated power for devices where the "radiating structure" is within 2.5 centimeters of the body. Id.

TRW supports the Commission's proposal for exclusion of low-power devices, and expects that the handsets for use with Odyssey will be eligible for exclusion under at least one of the alternative formulations to be adopted. It asks for clarification of two items, however.

First, TRW notes that the term "radiating structure" is not defined in the ANSI/IEEE definitions section. The Commission has indicated that the term "may include parts of the device other than the antenna itself . . . ." NPRM, 8 FCC Rcd at 2851. Because no further guidance is provided either by ANSI/IEEE or by the Commission, TRW recommends that the definition be clarified. It suggests that the following definition would suffice: "'Radiating structures' are pieces of electrically conductive material which are larger than one-eighth of the shortest wavelength of the emitter [which] are 2.5 cm or closer to the antenna."

In response to the Commission's call for comments on how SAR measurements should be made and submitted, TRW notes that SAR measurement, as per the ANSI/IEEE guidelines, is not a specific procedure. Instead, it is a set of possible techniques. Indeed, there is a high potential for ambiguity of test results because the techniques involve the variability of the human body

(or non-uniformity of substitutes therefor). TRW believes that the Commission should require SAR measurements that are based on unambiguous field strength readings at specific frequencies and distances from the subject device. Such procedures are necessary to ensure uniform conformity to recognized health standards.

C. If Any RF Exposure Guidelines Are To Be Selected, The Commission Should Select The ANSI/IEEE Guidelines.

In its NPRM, the Commission notes that some studies recommend guidelines more stringent than those contained in the 1992 ANSI/IEEE guidelines. NPRM, 8 FCC Rcd at 2852-53. It asked for comment on whether exposure guidelines different from those stated in the ANSI/IEEE paper should be considered. Id.

It remains the case that assessing the potential for health risks from exposure to RF fields is an evolving art. In this regard, the ANSI/IEEE guidelines incorporate the greatest flexibility and latitude for measurement of the alternate studies cited in the NPRM. For example, the recommendations contained in the National Council on Radiation Protection and Measurements ("NCRP") study that is cited by the Commission, in addition to specifying slightly more stringent limitations than are proposed by ANSI/IEEE, do not incorporate an associated set of averaging times. This leads to an assumption that all emitters are in continuous use, and such an assumption simply does not comport with real-life situations.

In short, the 1992 ANSI/IEEE guidelines, though not perfect, are preferable to the recommendations contained in the guidelines separately issued some years ago by the NCRP (1986) and the International Non-Ionizing Radiation Committee of the International Radiation Protection Association (1988). If the Commission proceeds with its proposal to implement new RF exposure guidelines, it should adopt the ANSI/IEEE standards.

D. The Commission Should Require Recertification Of Equipment Where New, Lower-Emission Devices Will Share Spectrum With Older, Higher-Power Transmitters.

In the NPRM, the Commission asks how it should treat equipment and facilities that are in use but not in compliance with the new RF guidelines. NPRM, 8 FCC Rcd at 2853. It specifically inquires whether it should require re-submission of certain equipment authorization applications. Id.

TRW is of the view that the Commission should require measurement and recertification of existing equipment and facilities. In order to comply with the 1992 ANSI/IEEE guidelines, many transmitters will have to operate at lower radiated power emission levels than have been required to date. As a result, receiving equipment will have to be increasingly sensitive, and thus increasingly susceptible to interference. If the Commission is to ensure the technical viability of communication systems with lower emissions, it must pursue a

policy of uniform adherence to lower emissions -- a policy that of necessity includes existing equipment that operates on the same frequencies.

TRW recognizes that such a policy may have short-term financial implications. However, the impact would be limited, in that recertification would only be necessary for industries where new receivers would have to be developed or used to adjust to the lower-power transmitters necessitated by the new RF rules. Grandfathering should be acceptable in other cases where older, higher-power transmitters do not negatively affect new lower-emission devices.

E. The Commission Should Take Steps To Ensure The Standardization Of The RF Measurement Process.

Noting that ANSI and IEEE have also issued a set of guidelines relating to the measurement of RF fields and specifying procedures for the quantitative determination of exposure, the Commission proposes to specify the ANSI/IEEE measurement guidelines for purpose of determining compliance with the 1992 ANSI/IEEE RF exposure guidelines. See NPRM, 8 FCC Rcd at 2853 & n.32. In TRW's view, the ANSI/IEEE guidelines are an outstanding compendium and tutorial on the state-of-the-art of electromagnetic field measurement. The report, however, is a set of guidelines, intended to assist the technical public in the admittedly challenging task of RF measurement. It is replete

with caveats about significant measurement uncertainty, and offers many options for equipment, orientation, and technique. It does not, however, offer a single "standard" measurement apparatus or practice.

The ANSI/IEEE measurement standards provide a good foundation upon which to build. If the Commission is to be successful in its desire to provide necessary protections to the public and still be even-handed in its treatment of equipment makers and service providers, it must, for each product type, embrace a single, unambiguous test that all manufacturers can use to ascertain compliance. It would seem that the Commission could provide a specification for a specific test apparatus and procedure for the measurement (based on the ANSI/IEEE guidelines) or, in the alternative, certify independent testing laboratories or facilities that will perform the measurement procedures for all manufacturers. If the Commission is to take its commitment to public safety seriously, it should adopt one or the other of these proposals.

III. CONCLUSION

On the basis of the foregoing discussion, TRW urges the Commission to revise certain aspects of its RF proposals in order to mitigate their impact on makers and operators of hand-held devices such as the handsets for use with Odyssey -- TRW's MSS

system. These steps can be taken without jeopardizing the public safety or otherwise causing potential health risks.

Respectfully submitted,

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ATTACHMENT

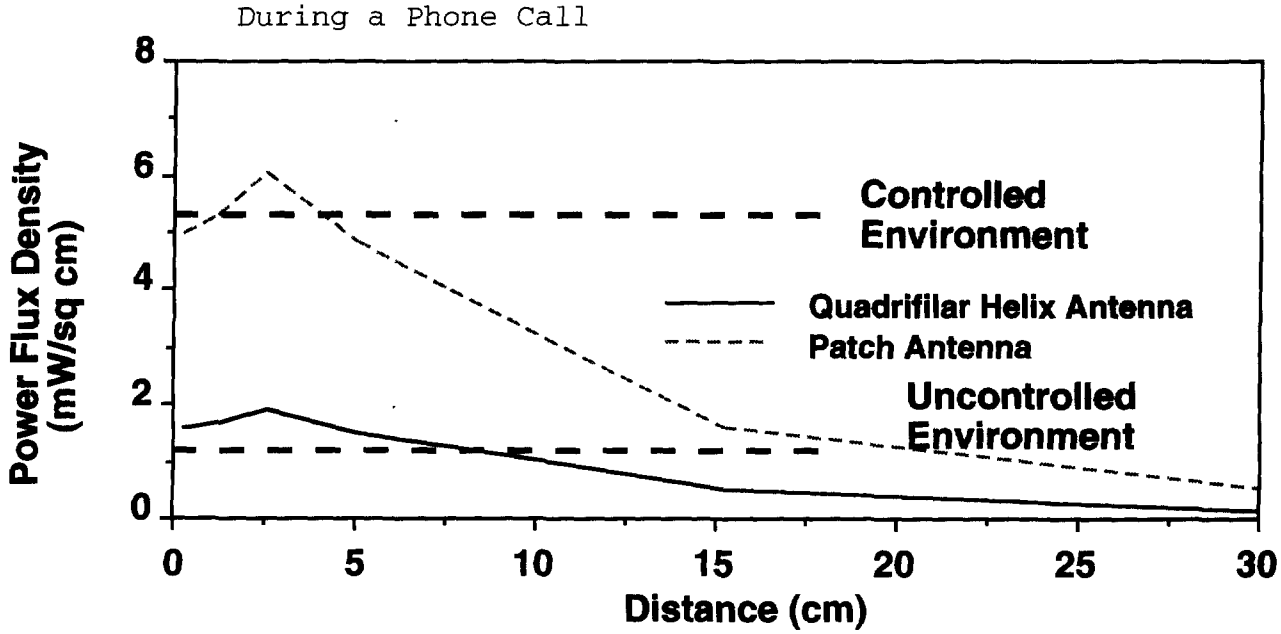
TECHNICAL STATEMENT

An analysis has been conducted of near-field antenna test data, in order to determine the ability of handsets operating with TRW Inc.'s ("TRW") "Odyssey" system.[1/] Intensity measurements of a 1.91 GHz patch antenna were taken, and the data from the measurements are included as Attachment 1. This data was needed to predict the compliance of handsets operating with Odyssey with the Institute of Electrical and Electronic Engineers ("IEEE") Standard C95.1.1991, "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

The data used by TRW was taken on a patch antenna with ~6 dBi gain. To date, TRW has considered patch and quadrifilar helix designs (~1 dBi average gain). The handset for use with TRW's Odyssey system has an average transmitter power of 0.5 Watt (1 Watt peak with a 50% voice duty cycle).

Figure 1 is a plot of the near-field power flux density ("PFD") during a phone call for the current Odyssey handset using the average power. Figure 1 includes the IEEE Std.C95.1.1991 limit of 1.08 and 5.39 mW/cm^2 based on the center band transmit frequency of 1.61825 GHz for uncontrolled and controlled environments, respectively.

Figure 1 -- Odyssey Handset Average L-Band Power Flux Density During a Phone Call



[1/] Odyssey is a trademark of TRW Inc. Odyssey is a satellite telecommunications systems which is to be comprised of a constellation of twelve satellites in a medium Earth orbit.

Note that neither antenna type satisfies the uncontrolled requirement at 2.5 cm distance from the antenna and that the patch antenna still exceeds the controlled requirement.

The IEEE Standard allows averaging for the purpose of compliance. If averaging can include the duration of a phone call, and the average phone call is less than the averaging time, then the PFD of the handset to be used with Odyssey will be less than that shown in Figure 1. If averaging can only include the voice duty factor of 50%, Figure 1 will apply. The averaging times allowed by the IEEE Standard are 30 and 6 minutes for uncontrolled and controlled environments, respectively. For purposes of analysis, TRW has assumed phone call durations of 3 minutes in all of its marketing calculations.

Figures 2 and 3 reflect the results of applying 3/30 or 3/6 duty factors to Figure 1, respectively.

Figure 2 -- Odyssey Handset PFD, Uncontrolled Environment, 3-Minute Phone Call

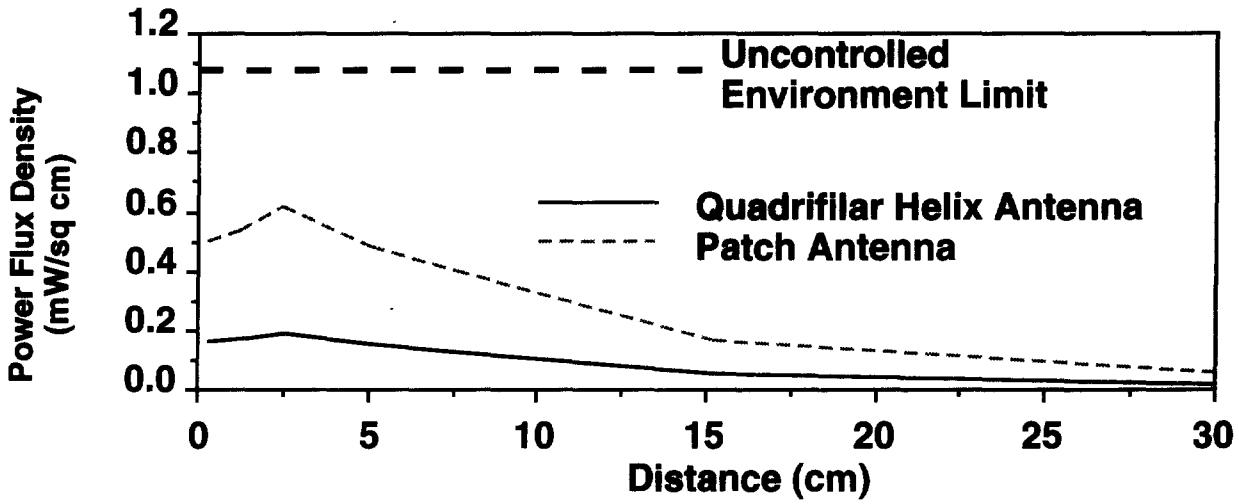
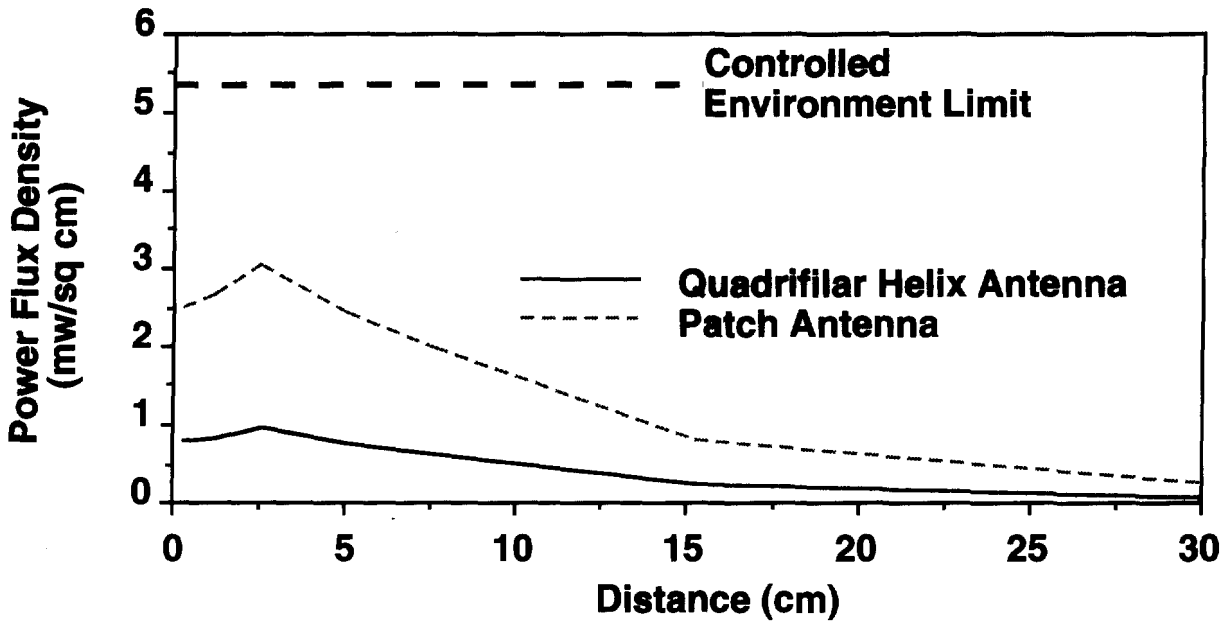


Figure 3 -- Odyssey Handset PFD, Controlled Environment, 3-Minute Phone Call



Both antennas satisfy the IEEE Standard using a single 3-minute phone call in the averaging time.

The duration of an average phone call may be the subject of further debate. Figures 4 and 5 are graphs of the maximum PFD (2.5 cm) as a function of the phone call duration for the uncontrolled and controlled environments, respectively.